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Filed: March 19, 1999
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REMARKS/ARGUMENTS

This amendment is responsive to the Official Action dated April 8, 2004. Claims 1 – 11 and 21 – 28 were previously pending in the application. Claims 1- 11, 21 – 23, 25, 26, and 28 are rejected, and claims 24 and 26 would be allowable if rewritten to include the limitations of the base claim and any intervening claims. By way of this amendment, the Applicant has cancelled claim 24, and amended claims 1, 6, and 26. Accordingly, claims 1 – 11, 21 – 23, and 24 - 28 are currently pending.

Rejections under 35 USC § 112, First Paragraph

Claims 6, 21, 22 and 26 are rejected under 35 USC 112, first paragraph. The Office Action states that the specification does not describe layers of the claimed thicknesses or a B-Stage resin in such a way that one of ordinary skill in the art would be able to make the invention.

Claim 6 recited an overall thickness of the “thin film carrier” of about “3 to about 25 mils”. The claim may have left some confusion about whether the “thin film carrier” recited in the claim identified the “film carrier” or the “thin film carrier layer” recited in claim 2. Claim 6 has been amended to clarify that the claim refers to the overall thickness of the “thin film carrier layer”. Further, claim 6 has been amended to recite a thickness from “about 6 to about 25 mils” in order to conform the claimed thickness with the specification. Support for the amendment is found on page 6, lines 18 – 24, of the originally filed specification.

Claim 21 recites the thicknesses of the “fibrous sublayer” and “continuous surface layer” first recited in claim 2. Support for the claimed thicknesses may be found on page 6, lines 18 – 24 of the originally filed specification.

Claim 22 recites that the thermosetting resin of the continuous surface layer is a B-stage resin. A B-stage resin, such as disclosed on page 7, line 4 of the originally filed specification, is understood in the art of thin polymer films to refer to an intermediate stage of curing. Applicant has included 4 documents with this response to illustrate that “B-stage” is a term of art known in

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the field relevant to this application. The first three are pages printed from various websites concerning thin films or printed circuits. Each of the documents refer to a B-stage resin in a context where it is readily apparent the term "B-stage" refers to an intermediately cured polymer. The fourth document is U.S. Patent 6,673,190 drawn to a printed wiring board where claim 1 of the patent recites a B-stage resin layer. In view of the several references to B-stage resins in publically available references related to the subject matter of the application, Applicant submits that the term "B-stage" is known in the art and is adequately supported by the specification as filed.

Claim 26 recites that the resin of claim 22 is an epoxy and that the ink layer maintains a resolution of 1 – 2 mm after curing. Support for these recitations may be found on page 7, lines 1 – 2, page 6, lines 7 – 10, and page 6, lines 24 – 25, respectively.

For the foregoing reasons, Applicants submit that claims 6, 21, 22, and 26 are described by the specification such that the rejection of these claims is therefore overcome.

Rejections under 35 USC § 112, Second Paragraph

Claims 6, 21 – 23 and 26 are rejected under 35 USC 112, second paragraph. Claims 6, 21, and 22 are rejected on the basis that various terms within the claims lack antecedent basis. Support for the recitations of claims 6, 21, and 22 has been demonstrated above, and the recitations do not lack antecedent basis.

Claims 22, 23, and 26 are rejected as indefinite based upon the recitation of a "B-stage resin". As shown above, the term "B-stage" resin is known in the art and it, therefore, does not render the claims indefinite.

For the foregoing reasons, Applicants submit that claims 6, 21 - 23, and 26 are described by the specification such that the rejection of these claims is therefore overcome.

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**Rejections under 35 USC § 103(a) as being unpatentable over
Kawai in view of Whyzmuzis**

Claims 1 – 11, 21 – 23, 25 and 28 are rejected under 35 USC 103(a) as being unpatentable over '422 Kawai in view of '526 Whyzmuzis.

The Office Action indicates that claim 24 would be allowable if rewritten. The recitations of claim 24 have been incorporated into independent claim 1. All remaining claims depend from claim 1, so all pending claims now contain the recitation of previously pending claim 24, now cancelled. Claim 26 has been further amended to correspond with the cancellation of claim 24. All pending claims are now allowable because the subject matter of a previously allowable claim has been incorporated into those claims. As such, the rejection under 35 U.S.C. § 103(a) has also been overcome.

Conclusion

Applicants appreciate the Examiner's consideration and admission of the amended claims. Applicants note that the claim amendments do not raise new issues. Instead, the amendment of claim 1 merely incorporates a recitation previously set forth by dependent claim 24, the amendment of claim 26 deletes a similar recitation to that now included in claim 1, and the amendment of claim 6 clarifies and more particularly defines the claimed subject matter. In view of the amended claims and the remarks submitted above, it is respectfully submitted that the present claims are in condition for immediate allowance. It is therefore respectfully requested that a Notice of Allowance be issued. The Examiner is encouraged to contact Applicants' undersigned attorney to resolve any remaining issues in order to expedite examination of the present application.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper.

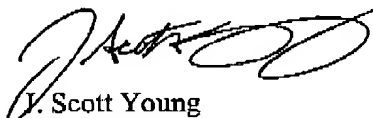
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However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

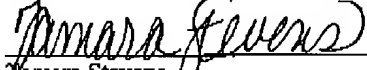


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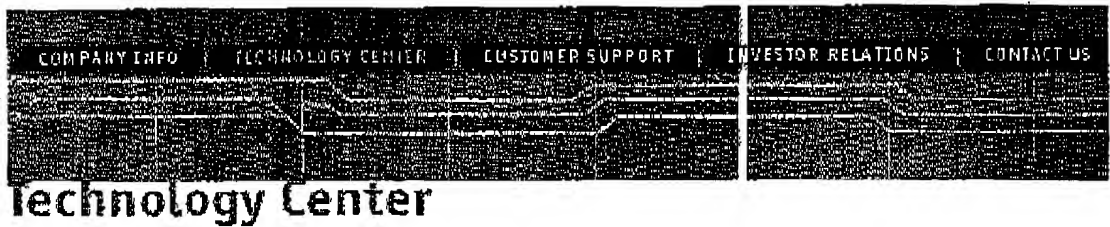
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I hereby certify that this paper is being facsimile transmitted to the US Patent and Trademark Office at Fax No. (703) 872-9306 on the date shown below.



Tamara Stevens

June 28, 2004
Date



Glossary

[A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [Z](#) [Acronyms](#)

A

Activating	A treatment that renders nonconductive material receptive to electroless deposition. Also called seeding, catalyzing, and sensitizing.
Additive Process	Any process in printed circuit board manufacturing where the circuit pattern is produced by the addition of metal.
Analytical Services Lab	Performs various tests such as plating thickness, inner layer connections to hole walls, photos or x-rays of circuit boards when required.
Annular Ring	The conductive material surrounding a hole.
Artwork Master	An accurately-scaled (usually 1:1) pattern which is used to produce the production master.
Aspect Ratio	The ratio of the circuit board thickness to the smallest drilled hole diameter.

B

B-Stage Material	Sheet material (fiberglass cloth) impregnated with a resin cured to an intermediate stage (B-stage resin). Prepeg is the preferred term.
Backplanes and Panels	Interconnection panels onto which printed circuits, other panels, or integrated circuit packages can be plugged or mounted. Typical thickness is 0.125" - 0.300."
Barrel	The cylinder formed by plating a drilled hole.
Base Copper	Copper foil provided in sheet form or clad to one or both sides of piece of laminate used as either internal or external layers of a circuit board.
Base Laminate	The dielectric material upon which the conductive pattern may be formed. The base material may be rigid or flexible.
Base Material	See Base Laminate.
Bed-of-Nails Technique	A method of testing printed circuit boards that employs a test figure mounting an array of contact pins configured so as to engage plated-through holes on the board.
Bleeding	A condition in which a plated hole discharges process material or solution from crevices or voids.
Blind Via Hole	A plated-through hole connecting an outer layer to one or more internal conductor layers of a multilayer printed board but not extending fully through all of the layers of base material.



Therm-H is a DMD laminate (Polyester non woven fibermat/polyester film/ polyester non woven fibermat) that is 100% pre-preg saturated with class F EP resins at B-stage (IEC draft 464-1).

Before curing **Therm-H** is slippery for an easy machinability.

The B-stage resin cures at time and temperature according to the recommended cycles.

After curing, the coating of **Therm-H** is rated to class F temperature (draft IEC 464-3.2 type 155) and sticks permanently the insulation to windings and core.

Typical properties

Type	D 50	D 75	D 100	D 125	D 190	D 250	D 350
Construction microns	65/50/65	65/75/65	56/100/65	65/125/65	65/190/65	65/250/65	65/350/65
Overall thickness (nominal) microns	195	220	245	270	335	395	495
Nominal weight g/m ²	190	225	260	295	380	470	610
Yield m ² /kg	5,25	4,45	3,85	3,40	2,60	2,10	1,65
Dielectric strength							
as supplied kV	8	9	11	12	15	17	20
after bending at 180°	7	8	10	11	4	16	19
Elongation %	20						
Melting Point °C	260						
Shrinkage at 150°C %	<2						
Standard reel width mm	1000						
ID/OD standard rolls mm	76 x 330						



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SMT Terms and Definitions

A | B | C | D | E | F | G | H | I | J | K | L | M | N | O
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A

- "A" Wave. Wave, "A"
- Å. Angstrom
- A/D Converter. Analog-To-Digital Converter
- Absorption. The retention of moisture by a substance.
- Accelerated Stress Test. A test to deliberately produce a failure.
- Acceptable Quality Level (AQL). Maximum number of defects per 100 pieces that are allowable.
- Acceptance Tests. Tests deemed necessary to determine the acceptability of products.
- Accuracy. (1) The ability to hit the target. (2) Conformity of a measured value to the actual value of the sample.
- Acoustic Microscopy. A nondestructive test that produces high resolution ultrasonic images, often used for inspecting component lid seals and die attach within components.
- Acrylic. A monomeric acrylate or methacrylate (acrylic acid or a derivative thereof) cured in a polymerization reaction brought on by ultraviolet energy, heat, or a combination of the two.
- Acrylic Resin. A thermosetting, transparent, flame resistant resin.
- ACS. American Chemical Society
- Activated Carbon. A water treatment medium, commonly used for de-chlorination and for reducing organic chemicals and radon from water. Activated Carbon is produced by heating carbonaceous substances (bituminous coal or cellulose-based substances such as wood or coconut shell) to 700°C or less in the absence of air to form a carbonized char, and then activating (oxidizing) at 800 to 1000°C with oxidizing gases such as steam and carbon dioxide to form pores, increasing the surface area of this adsorbent material. It can be in block, granulated, or powdered form.
- Activated Rosin Flux. Flux, Rosin Activated
- Activator. Thermally reactive compounds (such as amine hydrochlorides or various halides) that break down at elevated temperatures and enhance the ability of a flux to remove oxides and other contaminants from surfaces being joined.
- Active Components. Electronic components such as semiconductors, transistors, diodes, etc., that can change the characteristics applied electrical signal.
- Active Hold-Down. The process of pressing a component lead directly in contact with a bonding pad during soldering to ensure intimate contact between the lead and pad.
- Activity. (1) Activities may consist of moving or handling materials and components, changing machine or tool settings, turning equipment on or off, etc. Poorly control of activities can create process variability and varying quality. (2) Flux Activity
- ADC. Analog-To-Digital Converter
- Additive Plating. Plating, Additive
- Adhesion. The state in which two surfaces are held together by interfacial forces which may consist of valence forces or interlocking action.
- Adhesion, Mechanical. Adhesion between surfaces in which the adhesive holds the parts together by interlocking action.

- **Adhesive.** A substance capable of holding material together by surface attachment.
- **Adhesive, Anisotropic.** An adhesive with a low concentration of metal particles to permit conduction in the z-axis only.
- **Adhesive, Conductive.** A two part system comprised of a polymer base and a conductive filler.
- **Adhesive Failure.** Failure resulting from insufficient bond between the adhesive and one or both substrates. Adhesive strips away from substrates.
- **Adhesive Specific.** Adhesion between surfaces which are held together by valence forces or molecular bonding.
- **Adhesive Tensile Loading.** When the acting forces are applied at right angles to the plane of the adhesive. The tensile strength of a bond is the maximum tensile load per unit area, required to break the bond expressed in pounds per square inch.
- **Adhesive, Thermoplastic melt on application.** The process is reversible.
- **Adhesive, Thermoset** undergo a chemical change during heating. The change is not reversible. Epoxies and acrylics are thermosets.
- **AFM.** See atomic force microscope.
- **Ag.** Chemical symbol for the element silver.
- **Aging.** The change in the properties of a material over time and under varying conditions of humidity, temperature, pressure, etc.
- **Air Knife.** (1) A mechanical air pressure amplifier. (2) A plenum with a narrow opening used develop high velocity air from a low pressure air source to (a) dry / remove liquid films from surfaces (b) control the coating of surfaces, or (c) heat or cool.
- **Algorithm.** A set of rules specifying a sequence of actions taken to solve a problem.
- **Alignment Hole.** Tooling Hole
- **Alloy.** A substance made by melting two or materials together.
- **Alumina.** A common substrate material composed of approximately 95% Al_2O_3 .
- **Ambient Level.** The values of signals and noise that exist at a test location when the device under test is not active.
- **Amorphous Phase.** Non-crystalline. Most plastics are amorphous at processing temperature. Many retain this strength under normal temperatures.
- **Analog Circuit.** An electrical circuit that provides a continuous relationship between its input and output.
- **Analog-To-Digital Converter (ADC or A/D converter).** An electronic circuit that produces a digital output directly proportional to an analog signal input.
- **Anechoic Chamber.** An enclosure especially designed with walls that absorb sound or radiation, creating an essentially free-field environment for testing.
- **Angle Of Attack.** The angle between the squeegee and the stencil or screen.
- **Angstrom.** A unit of length equal to one hundred-millionth (10^{-8}) of a centimeter, often used to specify radiation wavelengths.
- **Anion.** An ion with a negative charge. An anion [such as chloride (Cl^-), nitrate (NO_3^-), bicarbonate (HCO_3^-), or sulfate (SO_4^{--})] may result from the dissociation of a salt, acid, or alkali.
- **Anion Exchange.** Ion Exchange. A water conditioning process.
- **Antioxidants.** Compounds that retard the rate of oxidation of a polymer.
- **Anisotropic.** Exhibiting different physical properties in different directions.
- **Anisotropic Adhesive.** Adhesive, Anisotropic
- **Annular Ring.** The pad area that remains after a hole is drilled through the pad.
- **ANSI.** American National Standards Institute
- **Antistatic Materials** resist turbocharging more than 200 volts.
- **Anti-Pad.** The area of copper etched away around a via or a plated through-hole on a power or ground plane, thereby preventing an electrical connection being made to that plane.
- **AOI.** Automated Optical Inspection
- **Application-Specific Integrated Circuit (ASIC).** An IC device whose function is designed for a specific application(s).
- **Aperture.** An opening in a stencil or screen.
- **Aperture, Chemical Etched.** An opening in metal stencil created by coating the metal foil with photoresist, exposing an image both sides the resist using a phototool, and etching the foil from both sides.

SMT in Line / SMT Terms and Definitions

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- Aperture, Electroformed. An opening in stencil formed by imaging a photoresist on a substrate and then plating the nickel foil around the resist to the desired thickness.
- Aperture, Electropolished. An electrolytic post-process that "smooths" the walls of aperture walls to improve solder paste printing.
- Aperture Files. Precise x-y location and shape of all apertures required on a printed circuit board.
- Aperture, Laser Cut. An opening in a metal stencil created by using Gerber® and aperture data to position a laser cutting head.
- Aperture, Trapezoidal. An aperture with the board side opening 1 to 2 mils larger than the squeegee side opening.
- API. Application Program Interface
- Application Program Interface. The interface between the application's software and the application platform.
- Application Software. A program that performs a specific service or solves a particular problem.
- AQL. Acceptable Quality Level
- Aqueous. A water soluble.
- Aqueous Cleaning. Cleaning, Aqueous
- Architecture. A structured set of protocols that implement the functions of the system.
- Array. A group of components arranged on rows and columns.
- Artwork. A phototool used to create (1) features during printed circuit board fabrication or (2) apertures on a screen or a chem-etched stencil.
- Artwork Generation. The process of transferring the CAD circuit layout to reproducible artwork for use by stencil and printed circuit board fabricators.
- Artwork Master. Artwork used to produce production masters.
- ASIC. Application Specific Integrated Circuit
- ASME. American Society of Mechanical Engineers
- Aspect Ratio. (1) Thickness of a printed circuit board to the diameter of the smallest hole. (2) Thickness of a stencil to the width of the smallest aperture.
- Assembler. A program that translates mnemonics into binary codes that run on a computer.
- Assembly. A functional subdivision of a component, consisting of parts or subassemblies that perform functions necessary for the operation of the component as a whole. Examples: regulator assembly, power amplifier assembly, gyro assembly, etc.
- AST. Accelerated Stress Testing
- ASTM. American Society for Testing and Materials
- Asynchronous. An action that takes place at an arbitrary time, without synchronization to a reference timer or clock.
- ATE. Automatic (Automated) Test Equipment
- Atm. Atmosphere pressure
- Atomic Force Microscope (AFM). A microscope that works by bringing a fine needle right up to the surface of a semiconductor and tracing the topography of the material. AFMs are an alternative to scanning electron microscopes as a means of measuring and monitoring the widths and heights of critical dimensions on an integrated circuit die.
- Au. Chemical symbol for the element gold.
- Automated Optical Inspection (AOI). A mechanized visual inspection process.
- AWG. American Wire Gauge
- Axial Lead. Lead wire extending from a component or module body along its long axis.
- Axial Leaded Components are usually cylindrical in shape and have leads exiting from opposite ends along its long axis.
- Azeotrope. A liquid mixture with a constant maximum or minimum boiling point lower or higher than the boiling points of its components and with the capacity to distill without change in composition.

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P | Q | R | S | T | U | V | W | X | Y | Z | NON-LETTER

B

- B-Stage Resin. An intermediate stage in curing a thermoset resin. Prepreg
- Back End Of The Line (BEOL). Test, assembly, and packaging of wafer manufacturing.
- Ball Bonding. Bonding, Ball
- Ball Grid Array (BGA) is surface mount technology IC package that provides electrical advantage of shorter signal and power paths and the mechanical advantage of greater interconnects and higher lead pitch, while decreasing package size.
- Bare Board. An unpopulated printed circuit board.
- Bare Die. An unpackaged integrated circuit.
- Barrel. The cylinder formed in the drilled through hole in a printed circuit board.
- Base Board. Base Material
- Base Material. In printed circuit board fabrication, the insulating laminate where the conductor pattern is formed.
- Batch. An entity that represents the production at any point in the process. A batch is a running control recipe. The material that is being produced or that has been produced by a single execution of a recipe is also considered a batch.
- Batch Control. Consists of a sequence of one or more steps (phases) that must be performed in a defined order for a finite period of time to process finite quantities of input material to produce finished product.
- Batch Manufacturing. Manufacturing in groups, lots or batches in which each part or finished good is identical.
- Batch Processing. The method adopted when the required product volumes do not allow continuous production of one product on particular machines.
- BBA. Bus Ball Array
- Bed-Of-Nails. A test fixture, used with (automated) test equipment, made of spring loaded contact pins (Pogo® pins) located to correspond with desired measurement points (nodes) on a printed circuit board.
- Bend Radius. The radius at the inside of the bend at (1) the lead shoulder leading to the leg and (2) the base of the leg leading to the foot.
- BEOL. Back End Of The Line
- BGA. Ball Grid Array
- Bi. Chemical symbol for the element bismuth.
- Bifurcated Terminal. Terminal, Bifurcated
- Binder. Materials added to pastes and adhesives to provide strength for handling purposes.
- Binning. Classifying components by their performance at the final test. The analogy is to physically drop things into different bins.
- Bipolar. (1) A signal that includes positive and negative values. (2) A type of semiconductor.
- Birdcage. A defect in stranded wire where the strands in the stripped portion between the covering of an insulated conductor and a soldered connection (or an end-tinned lead) have separated from the normal lay of the strands.
- BIST. Built-In Self Test
- BIT. Built-In Test
- Blind Via. Via, Blind
- Blister. Raised areas on the surface of the laminate caused by the pressure of volatile substances entrapped within the laminate.
- Blow Hole. A cavity in the solder surface whose opening has an irregular and jagged form, without a smooth surface.
- Board. Printed Circuit Board
- Board-Level (Circuitry) Repair. Repair, Board-Level (Circuitry)
- BOD. Biological Oxygen Demand
- Bond Strength. The force per unit area required to separate two adjacent layers of a package. The force is applied perpendicular to the surface of the package.
- Bonding. Joining of two materials.
- Bonding Alloy. Solder
- Bonding, Ball. A wire bonding method that melts a sphere of gold wire, melts the sphere at the first connection point, draws a loop in the wire, and makes a wedge bond at the other connection point.
- Bonding, Die. The attachment of an integrated circuit chip to a substrate.



US 6,673,190 B2

LASABLE BOND-PLY MATERIALS FOR HIGH DENSITY PRINTED WIRING BOARDS

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Assigned to Honeywell International Inc., Morristown, N.J. (US)

Filed on Apr. 04, 2001, as Appl. No. 9/826,718.

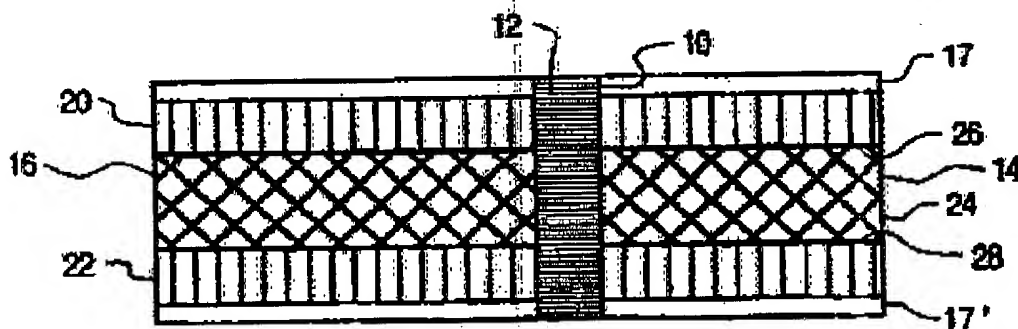
Application 09/826718 is a division of application No. 09/344749, filed on Jun. 25, 1999, granted, now 6245696.

Prior Publication US 2002/0004352 A1, Jan. 10, 2002

Int. Cl. ⁷B32B 31/00

U.S. Cl. 156—289

9 Claims



1. A method for interconnecting high density electronic circuits comprising the steps of:
 - (a) forming a bond-ply material comprising a core having a first surface and a second surface wherein the core has a thickness of from about 5 microns to 200 microns and including from about 20 to 70 weight % non-woven reinforcement material selected from glass microfibers, organic fibers and mixtures thereof impregnated with a polymer, the bond-ply material also comprising a B-stage resin layer having a thickness of from about 2 micrometers to about 200 micrometers covering the core first surface, the core second surface, or both the core first surface and the core second surface;
 - (b) forming a plurality of vias in the bond-ply material;
 - (c) filling the vias with an electrically conductive material selected from a conductive paste or conductor precursor;
 - (d) placing the bond-ply material between a first circuit element having at least one circuit region and a second circuit element having at least one circuit region such that the electrically conductive material located in at least one via contacts at least one circuit region associated with the first circuit element and at least one circuit region associated with the second circuit element to form an uncured multi-layer circuit; and
 - (e) curing the uncured multi-layer circuit at a pressures of from 0 to 1000 psi and at a temperature of from 25 to about 400° C. to form a cured multi-layer circuit.